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ACST6

Features

- Triac with overvoltage protection
- Low I_{GT} (< 10 mA)
- TO-220FPAB insulated package: 1500 V rms

Benefits

- Enables equipment to meet IEC 61000-4-5
- High off-state reliability with planar technology
- Needs no external overvoltage protection
- Reduces the power passive component count
- High immunity against fast transients described in IEC 61000-4-4 standards

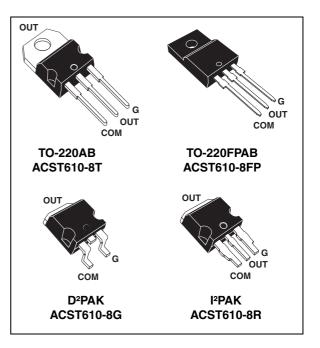
Applications

- AC mains static switching in appliance and industrial control systems
- Drive of medium power AC loads such as:
 - Universal motor of washing machine drum
 - Compressor for fridge or air conditioner

Description

The ACST6 series belongs to the ACS™/ACST power switch family built with A.S.D.[®] (application specific discrete) technology. This high performance device is suited to home appliances or industrial systems, and drives loads up to 6 A.

This ACST6 switch embeds a Triac structure and a high voltage clamping device able to absorb the inductive turn-off energy and withstand line transients such as those described in the IEC 61000-4-5 standards. The ACST610 needs only low gate current to be activated ($I_{GT} < 10$ mA) and still shows a high noise immunity complying with IEC standards such as IEC 61000-4-4 (fast transient burst test).



Overvoltage protected AC switch



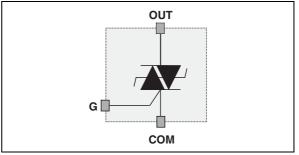


Table 1.Device summary

Symbol	Value	Unit
I _{T(RMS)}	6	А
V _{DRM} /V _{RRM}	800	V
I _{GT}	10	mA

TM: ACS is a trademark of STMicroelectronics. (B): A.S.D. is a registered trademark of STMicroelectronics

1 Characteristics

Table 2.	Absolute fattings (initiality values)						
Symbol	Parameter	Parameter					
		TO-220FPAB	T _c = 92 °C				
I _{T(RMS)}	On-state rms current (full sine wave)	TO-220AB/ D ² PAK / I ² PAK	T _c = 106 °C	6	A		
		D ² PAK with 1 cm ² copper	T _{amb} = 62 °C	1.5			
1	Non repetitive surge peak on-state current Ti	F = 60 Hz	t _p = 16.7 ms	47	А		
I _{TSM}	initial = 25 °C, (full cycle sine wave)	F = 50 Hz	t _p = 20 ms	45	А		
l ² t	I ² t for fuse selection		t _p = 10 ms	13	A ² s		
dl/dt	Critical rate of rise on-state current $I_G = 2 \times I_{GT}$, (t _r $\le 100 \text{ ns}$)	F = 120 Hz	T _j = 125 °C	100	A/µs		
V _{PP}	Non repetitive line peak pulse voltage ⁽¹⁾		T _j = 25 °C	2	kV		
P _{G(AV)}	Average gate power dissipation		T _j = 125 °C	0.1	W		
P _{GM}	Peak gate power dissipation ($t_p = 20 \ \mu s$)		T _j = 125 °C	10	W		
I _{GM}	Peak gate current (t _p = 20 µs)		T _j = 125 °C	1.6	А		
T _{stg}	Storage temperature range				°C		
Тј	Operating junction temperature range	-40 to +125	°C				
Τ _Ι	Maximum lead solder temperature during 10 m	260	°C				
V _{INS(RMS)}	Insulation rms voltage	TO-220FPAB		1500	V		

Table 2. Absolute ratings (limiting values)

1. According to test described in IEC 61000-4-5 standard and Figure 19.

Table 3.Electrical characteristics

Symbol	Test conditions	Quadrant	Тj		Value	Unit
I _{GT} ⁽¹⁾	V_{OUT} = 12 V, R_L = 33 Ω	- -	25 °C	MAX.	10	mA
V _{GT}	V_{OUT} = 12 V, R_L = 33 Ω	- -	25 °C	MAX.	1.0	V
V _{GD}	$V_{OUT} = V_{DRM}, R_L = 3.3 \text{ k}\Omega$	1 - 11 - 111	125 °C	MIN.	0.2	V
I _H (2)	I _{OUT} = 500 mA		25 °C	MAX.	25	mA
١L	$I_G = 1.2 \text{ x } I_{GT}$	-	25 °C	MAX.	30	mA
١L	$I_{G} = 1.2 \text{ x } I_{GT}$	II	25 °C	MAX.	40	mA
dV/dt ⁽²⁾	V _{OUT} = 67 % V _{DRM} , gate open		125 °C	MIN.	500	V/µs
(dl/dt) _c ⁽²⁾	$(dV/dt)_c = 15 V/\mu s$		125 °C	MIN.	3.5	A/ms
V _{CL}	$I_{CL} = 0.1 \text{ mA}, t_p = 1 \text{ ms}$		25 °C	MIN.	850	V

1. Minimum I_{GT} is guaranteed at 5% of I_{GT} max

2. For both polarities of OUT pin referenced to COM pin

Symbol	Test conditions			Value	Unit
V _{TM} ⁽¹⁾	$I_{OUT} = 2.1 \text{ A}, t_p = 500 \ \mu s$	T - 25 °C	MAX.	1.4	v
▼TM` ´	$I_{OUT} = 8.5 \text{ A}, t_p = 500 \ \mu \text{s}$	T _j = 25 °C		1.7	
V _{T0} ⁽¹⁾	Threshold voltage	T _j = 125 °C	MAX.	0.9	V
$R_d^{(1)}$	Dynamic resistance	T _j = 125 °C	MAX.	80	mΩ
I _{DRM} I _{RRM} V _{OUT} = V _{DRM} / V _{RRM}		T _j = 25 °C	MAX.	20	μA
	VOUT = VDRM/ VRRM	T _j = 125 °C	MAX.	500	μA

Table 4.Static characteristics

1. For both polarities of OUT pin referenced to COM pin

Table 5.Thermal resistances

Symbol	Parameter	Value	Unit	
Rt _{h(j-a)} Junction to ambient Junction to ambient (soldered on 1 cm ² copper pad)	Junction to ambient	TO-220AB TO-220FPAB	60	
	I ² PAK	65	°C/W	
	Junction to ambient (soldered on 1 cm ² copper pad)	D ² PAK	45	
		TO-220FPAB	4.25	
R _{th(j-c)}		TO-220AB D ² PAK , I ² PAK	2.5	°C/W

Figure 2. Maximum power dissipation versus Figure 3. rms on-state current

On-state rms current versus case temperature (full cycle)

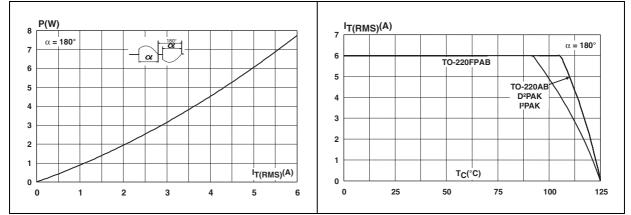
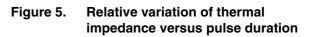
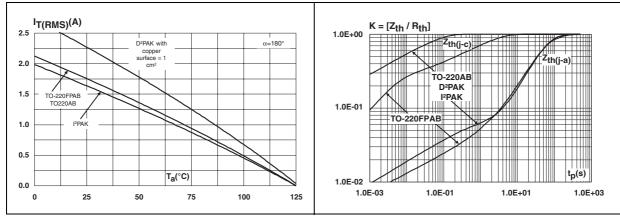




Figure 4. On-state rms current versus ambient temperature (free air convection, full cycle)





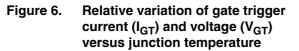


Figure 7. Relative variation of holding current (I_H) and latching current (I_L) versus junction temperature

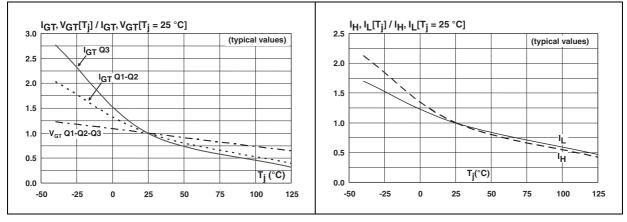


Figure 8. Surge peak on-state current versus number of cycles

Figure 9. Non re

Non repetitive surge peak on-state current and corresponding value of I²t versus sinusoidal pulse width

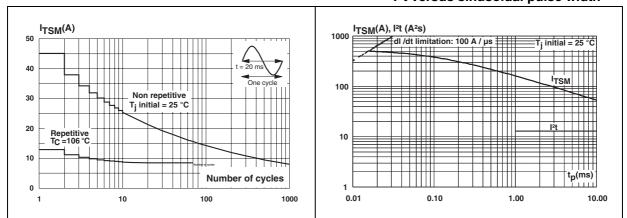
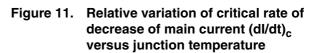




Figure 10. On-state characteristics (maximum values)



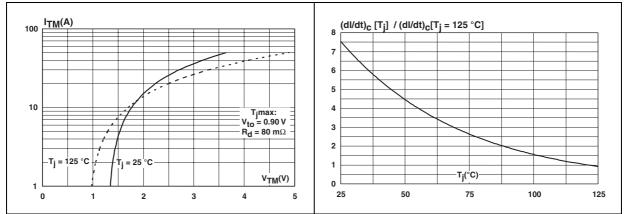
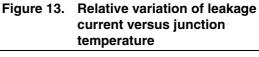


Figure 12. Relative variation of static dV/dt immunity versus junction temperature (gate open)



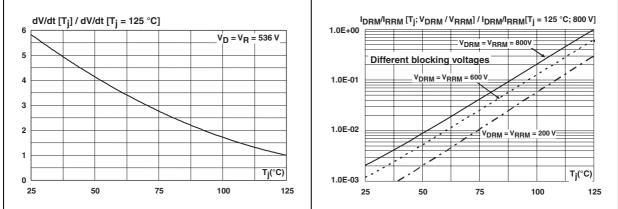
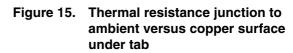
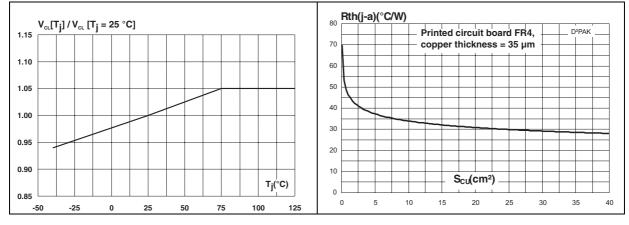


Figure 14. Relative variation of clamping voltage (V_{CL}) versus junction temperature (minimum values)







2 Application information

2.1 Typical application description

The ACST6 device has been designed to control medium power load, such as AC motors in home appliances. Thanks to its thermal and turn off commutation performances, the ACST6 switch is able to drive an inductive load up to 6 A with no turn off additional snubber. It also provides high thermal performances in static and transient modes such as the compressor inrush current or high torque operating conditions of an AC motor. Thanks to its low gate triggering current level, the ACST6 can be driven directly by an MCU through a simple gate resistor as shown *Figure 16* and *Figure 17*.

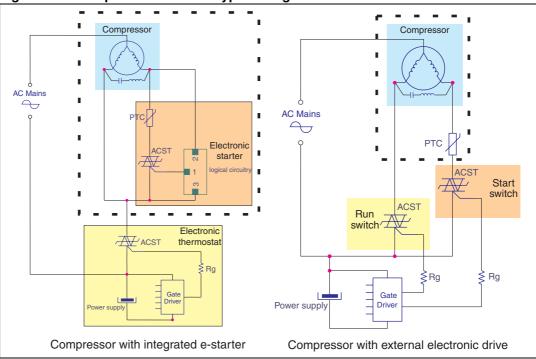


Figure 16. Compressor control – typical diagram



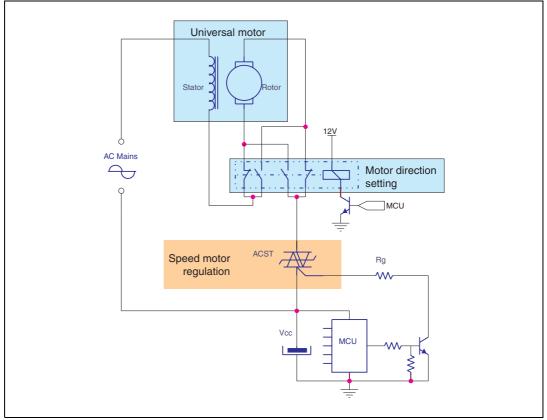


Figure 17. Universal drum motor control – typical diagram

2.2 AC line transient voltage ruggedness

In comparison with standard Triacs, which are not robust against surge voltage, the ACST6 is self-protected against over-voltage, specified by the new parameter V_{CL} . The ACST6 switch can safely withstand AC line transient voltages either by clamping the low energy spikes, such as inductive spikes at switch off, or by switching to the on state (for less than 10 ms) to dissipate higher energy shocks through the load. This safety feature works even with high turn-on current ramp up.

The test circuit of *Figure 18* represents the ACST6 application, and is used to stress the ACST switch according to the IEC 61000-4-5 standard conditions. With the additional effect of the load which is limiting the current, the ACST switch withstands the voltage spikes up to 2 kV on top of the peak line voltage. The protection is based on an overvoltage crowbar technology. The ACST6 folds back safely to the on state as shown in *Figure 19*. The ACST6 recovers its blocking voltage capability after the surge and the next zero current crossing. Such a non repetitive test can be done at least 10 times on each AC line voltage polarity.



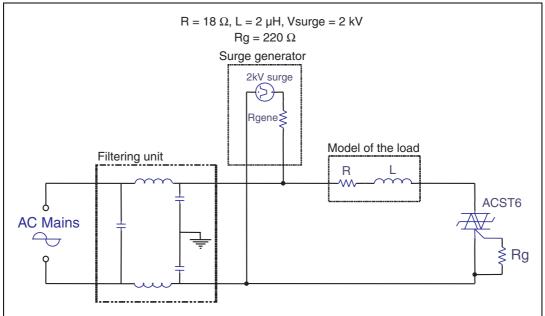
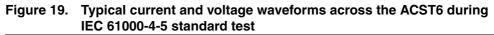
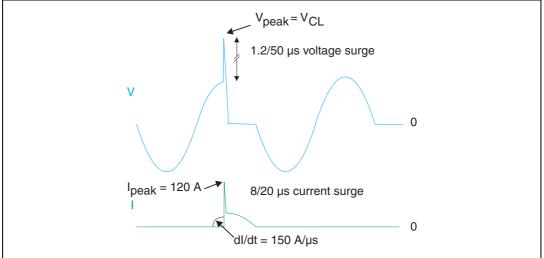


Figure 18. Overvoltage ruggedness test circuit for resistive and inductive loads for IEC 61000-4-5 standards







3 Ordering information scheme

Figure 20.	Ordering	information	scheme
i iguic zo.	oracing	mormation	Solicilie

AC switch	ACS T 6 10 - 8 G TR
Тороlogy	
T = Triac	
On-state rms current	
6 = 6 A	
Triggering gate current 10 = 10 mA Repetitive peak off-state voltage 8 = 800 V	
Package	
FP = TO-220FPAB T = TO-220AB B = I ² PAK	
$G = D^2 PAK$	
Delivery mode TR = Tape and reel	





4 Package information

- Epoxy meets UL94, V0
- Cooling method: by conduction (C)
- Recommended torque value (TO220AB, TO220FPAB): 0.4 to 0.6 N·m

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK[®] packages, depending on their level of environmental compliance. ECOPACK[®] specifications, grade definitions and product status are available at: <u>www.st.com</u>. ECOPACK[®] is an ST trademark.

Table 6. TO-220AB dimensions

			Dimensions Millimeters Inches			
		Ref.	Millin	neters	Inc	hes
			Min.	Max.	Min.	Max.
		А	4.40	4.60	0.173	0.181
	•	С	1.23	1.32	0.048	0.051
	A ·	D	2.40	2.72	0.094	0.107
	-	Е	0.49	0.70	0.019	0.027
	. L7	F	0.61	0.88	0.024	0.034
		F1	1.14	1.70	0.044	0.066
		F2	1.14	1.70	0.044	0.066
F2		G	4.95	5.15	0.194	0.202
$ \downarrow F1 \rightarrow F4 \downarrow f \downarrow $	▶_	G1	2.40	2.70	0.094	0.106
L4		H2	10	10.40	0.393	0.409
F→ ←		L2	16.4	typ.	0.64	5 typ.
G1 G1	E	L4	13	14	0.511	0.551
	≱∐₄_⊑	L5	2.65	2.95	0.104	0.116
, , , , , , , , , , , , , , , , , , ,		L6	15.25	15.75	0.600	0.620
		L7	6.20	6.60	0.244	0.259
		L9	3.50	3.93	0.137	0.154
		М	2.6	typ.	0.102	2 typ.
		Diam.	3.75	3.85	0.147	0.151





			Dimer	nsions	
	Ref.	Min. Max. Min. A 4.4 4.6 0.173 3 2.5 2.7 0.098 0 2.5 2.75 0.098 0 2.5 2.75 0.098 0 2.5 2.75 0.098 1 0.45 0.70 0.018 1 1.15 1.70 0.045 2 1.15 1.70 0.045 2 1.15 1.70 0.045 1 2.4 2.7 0.094 1 10 10.4 0.393 2 16.Typ. 0.63 3 28.6 30.6 1.126 4 9.8 10.6 0.386 5 2.9 3.6 0.114 6 15.9 16.4 0.626	hes		
		Min.	Max.	Min.	Max.
	А	4.4	4.6	0.173	0.181
	В	2.5	2.7	0.098	0.106
	D	2.5	2.75	0.098	0.108
	E	0.45	0.70	0.018	0.027
	F	0.75	1	0.030	0.039
	F1	1.15	1.70	0.045	0.067
L2 L7	F2	1.15	1.70	0.045	0.067
	G	4.95	5.20	0.195	0.205
	G1	2.4	2.7	0.094	0.106
$ \begin{array}{c c} & & & \\ & & & & \\ & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ $	Н	10	10.4	0.393	0.409
L4 + F2	L2	16	Тур.	0.63 Тур.	
	L3	28.6	30.6	1.126	1.205
	L4	9.8	10.6	0.386	0.417
G	L5	2.9	3.6	0.114	0.142
	L6	15.9	16.4	0.626	0.646
	L7	9.00	9.30	0.354	0.366
	Dia.	3.00	3.20	0.118	0.126

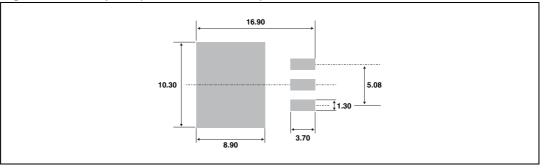
Table 7. TO-220FPAB dimensions



				Dimer	nsions		
		Ref.	Millimeters			Inches	
·			Min.	Max.	Min.	Max.	
		А	4.40	4.60	0.173	0.181	
		A1	2.49	2.69	0.098	0.106	
		A2	0.03	0.23	0.001	0.009	
		В	0.70	0.93	0.027	0.037	
			1.14	1.70	0.045	0.067	
	С	0.45	0.60	0.017	0.024		
↓ [⊤] Ц́ Щ́		C2	1.23	1.36	0.048	0.054	
→ B → B		D	8.95	9.35	0.352	0.368	
G		Е	10.00	10.40	0.393	0.409	
		G	4.88	5.28	0.192	0.208	
		L	15.00	15.85	0.590	0.624	
	M↓ ★↓ V2	L2	1.27	1.40	0.050	0.055	
	* FLAT ZONE NO LESS THAN 2mm	L3	1.40	1.75	0.055	0.069	
	TEAT ZONE NO LESS THAN ZIIIII	М	2.40	3.20	0.094	0.126	
		R	0.40	typ.	0.01	6 typ.	
		V2	0°	8°	0°	8°	

Table 8.D²PAK dimensions

Figure 21. Footprint (dimensions in mm)







		Dimensions			
	Ref.	Millin	neters	Inches	
		Min.	Max.	Min.	Max.
	Α	4.40	4.60	0.173	0.181
	A1	2.49	2.69	0.098	0.106
	В	0.70	0.93	0.027	0.037
L3	B2	1.14	1.70	0.045	0.067
	С	0.45	0.60	0.018	0.024
	C2	1.23	1.36	0.048	0.053
	D	8.95	9.35	0.352	0.368
G B2	E	10	10.40	0.394	0.409
→ ← B	G	4.88	5.28	0.192	0.208
	L	16.70	17.5	0.657	0.689
	L2	1.27	1.40	0.050	0.055
	L3	13.82	14.42	0.544	0.568

Table 9.I²PAK double track dimensions



5 Ordering information

Table 10.	Orderi	ng information	

Order code	Marking	Package	Weight	Base Qty	Packing mode
ACST610-8FP		TO-220FPAB	2.4 g	50	Tube
ACST610-8G		D ² PAK	1.5 g	50	Tube
ACST610-8GTR	ACST6108	D ² PAK	1.5 g	1000	Tape and reel
ACST610-8R		I ² PAK	2.3 g	50	Tube
ACST610-8T		TO-220AB	1.5 g	50	Tube

6 Revision history

Date	Revision	Changes
Jan-2002	7F	Previous issue.
09-May-2005	8	Layout update. No content change.
18-Dec-2009	9	Document structure and parameter presentation revised for consistency with other ACST documents. No technical changes. Order codes updated.
01-Jul-2010	10	Updated Figure 20.

Table 11. Document revision history



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